

Appendix D

Appendix D

Individual WRIA Overviews and Data

Note: The information in this appendix is from the 2001 Central Puget Sound Regional Water Supply Outlook.

Snohomish (WRIA 7)

With a drainage area of nearly 1,800 square miles, WRIA 7 covers a range of rural, suburban, and highly urbanized areas and extends from the Cascade Crest to Puget Sound. The Snoqualmie and Skykomish Rivers are the major surface water resources in this watershed, and they converge to form the Snohomish River about 20 miles upstream of Puget Sound. The Pilchuck River flows into the Snohomish downstream of this convergence. Major tributaries to the Skykomish include the North and South Forks of the Skykomish River, the Wallace River and the Sultan River. Major tributaries to the Snoqualmie River include the North, Middle, and South Forks of the Snoqualmie River, the Tolt River, and the Raging River. Snoqualmie Falls forms a significant natural barrier to anadromous fish passage into the upper Snoqualmie basin.

Everett, with a 2000 population of about 91,000, is the largest city within WRIA 7. Other cities and towns include Snohomish, Monroe, Sultan, Goldbar, Duvall, Carnation, Fall City, Snoqualmie, and North Bend. U.S. EPA classifies over 75 percent of the riparian area within WRIA 7 as forested, and less than 20 percent as urban or agricultural. However, much of the riparian habitat in WRIA 7 has been adversely impacted by flood control, road building, land development, agriculture, forest practices, and municipal water supply.

Surface water diversions from WRIA 7 for municipal use are primarily for the City of Everett and the City of Seattle, which operate water supply reservoirs on the Sultan and South Fork Tolt Rivers, respectively. Instream flow requirements were enacted by the state in 1979 for 10 control points on the Snohomish, Skykomish, Snoqualmie, Sultan, and Pilchuck Rivers. Additional instream flow requirements are in place as a condition to the Federal Energy Regulating Commission (FERC) Hydropower Licenses on the South Fork Tolt River and the Sultan River. WRIA 7 supports wild runs of coho, chinook, pink, chum, and steelhead (King County 1995a, Ecology 1995a).

Overview of WRIA 7 Activities

Summary

The Snohomish Basin Salmon Recovery Forum is preparing salmon recovery project lists under the Salmon Recovery Act (HB 2496) and developing a comprehensive watershed plan for salmon habitat conservation in the Snohomish River basin. This group serves as the convening body for stakeholder participation.

The Snohomish Basin Salmonid Recovery Technical Committee is co-chaired by individuals from Snohomish County Surface Water Management and King County. The Technical Committee includes representatives from King and Snohomish Counties, the Tulalip Tribes, City of Everett, City of Seattle, Ecology, Washington Department of Fish and Wildlife (WDFW), United States Forest Service (USFS), U.S. EPA, National Marine Fisheries Service (NMFS), Washington Trout, Stilly-Snohomish Fisheries Enhancement Task Force, and other conservation groups. There are also subcommittees to the Technical Committee that focus on habitat and research.

A Synthesis Committee (based on the earlier Snohomish Basin Workgroup) is responsible for reviewing recommendations of the Technical Committee and for considering the non-biological ramifications of recommendations to be submitted to the Snohomish Basin Salmon Recovery Forum. Membership is open, and active participation comes from Snohomish and King Counties, Cities of Everett and Seattle, Tulalip Tribes, Puget Sound Water Quality Action Team, and Ecology. The Synthesis Committee meets jointly with representatives of the Technical Committee in a coordination group.

Background on Assessment Processes

Ecology conducted a watershed characterization of land use, fish use and a variety of other factors and issued a report on their characterization (Ecology 1995a). The report identified subbasins that have flows that are or may in the future be significantly different than historical flows, but does not address the impacts of these flows on fish. This analysis was driven by predictions of historical and future use based on land use patterns.

The Snohomish Basin Workgroup hired a consultant (Pentec Environmental) to prepare a more detailed hydrology-based watershed assessment. Their report, "The Snohomish River Basin Conditions and Issues Report," has been completed and released (Pentec 1998).

The WRIA Technical Committee has developed the "Initial Snohomish River Basin Chinook Salmon Conservation/Recovery Technical Workplan." The document identified 34 habitat problem statements, with instream flows

ranked tenth in importance. The Technical Committee identified the top nine problem statements as the most important and used them as their basis for its chinook salmon recovery recommendations. Thus, low flows are not discussed as a high priority problem for chinook basin-wide; however, there may be some localized reaches where it may be a problem.

The Technical Committee went into more geographic detail in the “Snohomish River Basin Chinook Salmon Habitat Evaluation Matrix” (SBSRTC 2000). The matrix is an analysis of habitat conditions using the same geographic scale of subbasins used in Ecology’s watershed characterization. For each of the 62 subbasins, the Technical Committee evaluated seven major habitat conditions, including base flows and peak flows. Subbasins were classified as “properly functioning,” “at risk,” or “not properly functioning” for each of these conditions. Those subbasins that were classified as not properly functioning (based on percent impervious surface area) are listed in Table 5-3. It should be noted that the data used to determine total percent impervious area may be replaced in the near term, by results of a current model used by Snohomish County staff. The new model yields lower percent total impervious area values for these subbasins. Several subbasins in the flow matrix would likely “improve” as a result of the updated model predictions.

Evaluation of HB 2514 as a watershed planning approach for the Snohomish Basin

Ecology has provided an organizing grant, with the Tulalip Tribes and the City of Everett as co-leads, to evaluate whether or not the HB 2514 framework for watershed planning would be feasible in the Snohomish River watershed.

Scope of Activities

- ☐ Identify salmon recovery projects
- ☐ Develop a salmonid recovery plan that will recover salmon to healthy and harvestable levels

Mechanism for Identifying Water Quantity Needs for Fish

To date, except for analyses in the Tolt and Sultan basins, there has not been a detailed analysis performed on the water needs for fish in the Snohomish River watershed.

Interim Information as of 02/28/01

Table D-1: Snohomish (WRIA 7) Reported Flow Information (Page 1 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Pilchuck River - Middle	At RM 23	Summer		Condition is "At Risk." Withdrawals by City of Snohomish can take 10 to 20% of the summer low flow.	Pentec, 1999	
Bodell Creek		Summer		Surface Water Closure on 9/6/51 ³	WDOE IRPP - WRIA 7	
Skykomish - Lower Mainstem	Entire Subbasin	Not Identified	Chinook	Not Properly Functioning (NPF), estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	Instream flow augmentation from Sultan River (Jackson Project storage and instream flow schedules).
Woods Creek - Lower	Entire Subbasin	Not Identified		NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
May Creek	Entire Subbasin	Not Identified	Chinook	Surface Water Closure on 10/13/53 ³	WDOE IRPP- WRIA 7 -	
Ames Creek	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	Surface Water Closure per WDOE
Coal Creek - Lower	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Coal Creek - Upper	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Harris Creek	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface. ⁴ Also surface water closure on 1/20/44 ³	Purser et al., 2000 in SBSRTC, 2000 ⁵ WDOE IRPP - WRIA 7	Surface Water Closure per WDOE
Griffen Creek	Entire Subbasin	Not Identified		Surface water closure on 9/22/53 ³	WDOE IRPP - WRIA 7	Surface Water Closure per WDOE
Patterson Creek	Entire Subbasin	Not Identified		Surface water closure on 2/19/52 ³	WDOE IRPP - WRIA 7	Surface Water Closure per WDOE
Raging River	Entire Subbasin	Not Identified		Surface water closure on 9/20/51 ³	WDOE IRPP - WRIA 7	Surface Water Closure per WDOE

Interim Information as of 02/28/01

Table D-1: Snohomish (WRIA 7) Reported Flow Information (Page 2 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Snoqualmie River - Lower South Fork	Entire Subbasin	Not Identified	Chinook (below falls)	NPF, estimated based on % of impervious surface. ⁴ Potentially problematic in tributaries. Due to water rights and diversions (e.g., Riley Slough and Foye Creek)	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Snoqualmie River - Mouth	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Snoqualmie River - Mid-Mainstem	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Snoqualmie River - Upper Mainstem	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Cathcart Creek	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Dubuque Creek	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Everett Drainages	Entire Subbasin	Not Identified	Coho, chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Fobes Hill	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
French Creek	Entire Subbasin	Not Identified	Chinook, coho	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Lake Stevens	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Little Pilchuck Creek	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴ Also surface water closure on 5/6/52	Purser et al., 2000 in SBSRTC, 2000 ⁵	Surface Water Closure per WDOE

Interim Information as of 02/28/01

Table D-1: Snohomish (WRIA 7) Reported Flow Information (Page 3 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Marshland	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Pilchuck Creek - Lower	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Snohomish River - Estuary	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	Purser et al., 2000 in SBSRTC, 2000 ⁵	
Quilceda Creek	Entire Subbasin	Not Identified		Surface water closure on 6/10/46 ³	WDOE IRPP - WRIA 7	Surface Water Closure per WDOE
Sunnyside	Entire Subbasin	Not Identified	Chinook	NPF, estimated based on % of impervious surface ⁴	WCC, 1998	

NOTES:

¹ The "critical" low flow period usually occurs in the late summer (August and September). However, different periods in salmonids' life histories in fresh water may require varying instream flow requirements. Hence, it is possible that there could be different detrimental "low flows," depending upon river channel and fish life history in a particular water body.

² Low instream flows can occur due to urbanization, groundwater withdrawals, surface water diversions, and natural causes. Often the case is a combination. The Forum is focusing on identification & mitigation of the effects of human impacts.

³ NPF = Not Properly Functioning habitat condition for base flow, implying a low flow condition. (SBSRTC, 2000: based on % impervious surface area). NPF listings are based on unpublished data found in Purser, et al. (2000) indicating the subbasins had 13% to 57% total impervious area. The new model being performed by Snohomish County staff yields lower % total impervious area values for these subbasins, ranging from 6% to 53.5%. Several subbasins in this table would likely "improve" as a result of this new information. At this time, the information is only available to County staff, but plans are to release it to Technical Committees in the Snohomish, Stillaguamish, and Cedar-Sammamish WRIAs in the near future (Purser and Simmonds (unpublished)).

⁴ Order DE 79-8, WAC 173-507-040, filed 9/6/79 WA. Dept of Ecology, having determined there are no waters available for further appropriation through the establishment of rights to use water consumptively, closes these streams to further consumptive appropriation. The closures confirm surface water source limitations previously established administratively under chapter 90.03 RCW and RCW 75.20.050.

⁵ Scientific studies needed to verify source.

GENERAL NOTE: The Forum is attempting to report the greatest concerns for low flows in the basin. WRIA Technical Committee members have found water quantity information to be one of their largest data gaps. When identifying other limiting habitat factors, the technical committee identified some flow-related problems, as presented above. However, additional scientific study is required before they can consider the list comprehensive or prioritize flow problems in this system.

SOURCES:

Pentec Environmental, Inc. 1999. "Snohomish River Basin Conditions and Issues Report," prepared for the Snohomish River Basin Work Group. (pp. 7-43).

SBSRTC (Snohomish Basin Salmonid Recovery Technical Committee). 2000. "Snohomish River Basin Chinook Salmon Habitat Evaluation Matrix." Includes data from Purser et al., 2000.

WCC (Woodward-Clyde Consultants). 1998. "Draft Sunnyside Stormwater Infrastructure Plan – Existing Conditions and Preliminary Problems Report."

WDOE (Washington Department of Ecology). June 9, 1988. "Chapter 173-507 WAC, Instream Resources Protection Program, Snohomish River Basin, Water Resource Inventory Area (WRIA) 7."

Assessment Approach

- ☐ Department of Ecology characterization
- ☐ A hydrology-based watershed assessment
- ☐ A salmonid-based technical workplan
- ☐ A chinook salmon habitat evaluation matrix

Cedar-Sammamish (WRIA 8)

Located almost entirely within King County, the Cedar-Sammamish watershed (WRIA 8) covers nearly 700 square miles and spans the largest urbanized area within the State of Washington. Major cities include portions of Seattle (population 540,000 in 1998) as well as Bellevue, Kirkland, Redmond, Woodinville, Bothell, Sammamish, Issaquah, and Renton. The WRIA 8 watershed includes all surface waters that drain to Lake Washington and then through Lake Union, Salmon Bay, and Hiram Chittenden locks to Puget Sound.

Entering Lake Washington at Renton, the Cedar River originates at the Cascade crest. The Cedar River has been developed for municipal water supply by the City of Seattle with a storage reservoir at Chester Morse Lake/Masonry Pool and a diversion headworks at Landsburg. The Cedar River's major tributaries above Landsburg include the Rex River, Taylor Creek, and Rock Creek. Flood control levees have channelized much of the lower Cedar River. Although the Cedar River system contributes nearly 50 percent of the inflow to Lake Washington, it originally flowed to the Black River and then to the Duwamish-Green and Puget Sound. Instream Resources Protection Program (IRPP) instream flows have been enacted at Renton. As part of its Cedar Habitat Conservation Plan (HCP), the City of Seattle has entered into instream flow agreements that guarantee certain minimum flows will be provided on the Cedar as measured at Landsburg.

Entering Lake Washington near Bothell, the Sammamish system includes Lake Sammamish and the Sammamish River, which connects the two lakes. Major tributaries to Lake Sammamish include Issaquah, Tibbetts, and Laughing Jacobs Creeks; major tributaries to the Sammamish River include Big Bear, Bear, North, and Swamp Creeks. In addition to the Cedar and Sammamish systems, a number of smaller streams drain directly into Lake Washington.

The Cedar-Lake Washington system supports runs of chinook, coho, sockeye, and steelhead. Chester Morse Lake supports a population of bull trout (Ecology 1995b, Ecology 1999, Seattle 1999, Seattle 2000).

Overview of WRIA 8 Activities

The Cedar-Sammamish WRIA is planning under HB 2496. Representation on the WRIA Steering Committee includes jurisdictions, governmental agencies,

environmentalists, and business interests. Although the Muckleshoot Tribe has been invited, they have not participated on the Steering Committee.

The two other primary committees of the planning effort are the Staff Committee and the Technical Committee.

Scope of Activities

In the Cedar-Lake Washington basin, the WRIA planning process involves two basic products—a watershed assessment and a Salmon Conservation Plan—each of which is being phased into and has a near-term and long-term component as follows:

Watershed Assessment – Reconnaissance Phase. This phase will result in a Reconnaissance Assessment Report that, based on existing information on salmon and salmon habitat conditions, identifies factors of decline in subareas and the level of certainty associated with each factor of decline. The Reconnaissance Assessment Report is currently being finalized and will form the basis for the Near-Term Action Agenda phase of the WRIA 8 Salmon Conservation Plan.

Watershed Assessment – Strategic Assessment Phase. This phase will involve original research and collection and analysis of data to fill important information gaps identified in the reconnaissance phase. This phase will result in a report to the WRIA 8 Steering Committee in about June 2003 and will form the basis for the Long-Range Salmon Conservation Plan for WRIA 8.

WRIA 8 Salmon Conservation Plan – Initial Action Agenda (Phase 1). Based on the reconnaissance phase watershed assessment, the action agenda will recommend early and interim action projects, policies, and programs, focusing on actions that are likely to remain high priorities as the overall WRIA 8 salmon conservation plan is developed. As part of its initial efforts, WRIA 8 has recommended and ranked eight projects and requested \$1.6 million from the Salmon Recovery Funding (SRF) Board for implementation. The SRF Board has approved five projects with funding of just over \$1 million. Other projects are likely to be added to the list as the Initial Action Agenda is finalized.

WRIA 8 Comprehensive Salmon Conservation Plan (Phase 2). This habitat-based plan is the ultimate product of the WRIA planning process and will build on the two phases of the watershed assessment and Initial Action Agenda. The WRIA 8 Steering Committee has set June 2005 as the target date for obtaining approval for the Plan by the National Marine Fisheries Service and U.S. Fish and Wildlife Service.

Assessment Approach

The WRIA Steering Committee expects to use a number of approaches to assess salmon-related watershed conditions. Initial reconnaissance work to identify potential limiting factors was based on the outcome of a series of technical workshops and a review of existing data on salmonid distribution. Subsequently, additional workshops will be held to prioritize where additional data collection and analysis is needed (research agenda and strategic assessment work program).

Mechanism for Identifying Where Water Quantity Is a Potential Factor of Decline for Fish

WRIA 8 is establishing the following mechanisms for identifying where streamflows are a potential factor of decline for fish:

- ❑ **Initial Assessment of Factors of Decline.** As part of the Reconnaissance Assessment Report potential factors of decline, which can include streamflows, will be identified. The certainty ascribed to each potential factor (known, probable, and possible) will also be identified.
- ❑ **Strategic Assessment and Salmon Conservation Plan.** These efforts will prioritize factors of decline, including streamflows, and long-term actions to address them and conserve salmon.

Interim Information as of 02/28/01

Table D-2: Cedar-Sammamish (WRIA 8) Reported Flow Information

(This information was not available at the time this document was printed. The WRIA 8 Technical Subcommittee will make more comprehensive data available in the near future.)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
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(The WRIA 8 Technical Committee is in the process of developing a DRAFT Reconnaissance Assessment of the Habitat Factors that contribute to the Decline of Salmonids in the Lake Washington Watershed. The purpose of this report is to summarize existing information on salmonid populations and distribution and the conditions of salmonid habitat in the watershed. The report will identify habitat factors of decline, including surface flows, by subarea in the WRIA 8 watershed. It will also identify gaps in current data and technical understanding and recommend general strategies for addressing the habitat factors of decline.)

NOTES:

- ¹ The "critical" low flow period usually occurs in the late summer (August and September). However, different periods in salmonids' life histories in fresh water may require varying instream flow requirements. Hence, it is possible that there could be different detrimental "low flows," depending upon river channel and fish life history in a particular water body.
- ² Low instream flows can occur due to urbanization, groundwater withdrawals, surface water diversions, and natural causes. Often the case is a combination. The Forum is focusing on identification & mitigation of the effects of human impacts.

Duwamish-Green (WRIA 9)

Encompassing nearly 500 square miles, the Duwamish-Green watershed (WRIA 9) is located within King and Pierce counties. Major tributaries to the Duwamish-Green include the Black River and Neuwakum, Soos, Covington, Jenkins, and Mill Creeks.

Cities and towns within WRIA 9 include Tukwila, Kent, Auburn and Enumclaw as well as portions of the City of Seattle along the Duwamish waterway. WRIA 9 also includes much of the rapidly growing area of southwest King County. U.S. EPA classifies about 20 to 50 percent of the riparian habitat in the Duwamish-Green system as forested and about 20 to 50 percent as urban/agricultural. However, much of the riparian habitat in the lower Green River has been channelized for flood control, and much of the riparian corridor along the Duwamish waterway is now heavily industrialized. Howard Hanson Dam and Reservoir, located in the upper Green River basin, are operated by the U.S. Army Corps of Engineers for flood control and low flow augmentation. The City of Tacoma has a water supply diversion farther downstream near Palmer.

The Duwamish-Green system supports runs of chinook, coho, chum, pink, and steelhead. Minimum instream flows have been enacted by the state for the Green River at control points at Palmer and Auburn. These minimums condition Tacoma's second diversion water right on the Green River. Through an agreement with the Muckleshoot Indian Tribe and its proposed Green River Habitat Conservation Plan, the City of Tacoma also guarantees minimum flows at Auburn as a condition of developing its second water right. Once the second diversion right is developed, these guarantees must be met even if Tacoma has to curtail diversions under its first water right or supplement flows from storage. (Revisions to the operations of Howard Hanson Dam will also allow for its operation to encompass municipal water supply.) Tacoma's agreement with the Muckleshoot Tribe also establishes additional instream flow requirements at Auburn and Palmer that are higher than state minimums during certain times of year (Ecology 1995c, Tacoma 1995, Tacoma 1999, USDI et al. 2000, U.S. EPA 2000).

Overview of WRIA 9 Activities

Summary

A Limiting Factors and Reconnaissance Assessment Report was completed for WRIA 9 in December 2000 (Kerwin and Nelson 2000). This report was a joint effort between the Washington State Conservation Commission and the WRIA 9 planning effort. It includes a description of limiting factors and fish distribution in the WRIA (including tributaries and the nearshore) based on known existing information. The document also includes key findings and a description of data gaps for factors of decline, as well as a strategy and initial

recommendations for the Duwamish-Green Watershed. A report on the nearshore, including an existing conditions report and initial recommendations, was completed May 2001. Next steps in the planning process include developing and implementing a strategic assessment and near-term action agenda.

Background

The Duwamish-Green watershed is planning under HB 2496 framework. There was an attempt to form a HB 2514 process but this was abandoned due to concerns with the role of tribes under that statute. Policy direction and oversight for WRIA 9 is provided by the Steering Committee.

Beginning in 2001 the WRIA 9 planning effort is staffed regionally through an interlocal agreement. Through this agreement four-and-one-half staff positions are funded interjurisdictionally to provide support to the planning effort. The work program and budget are approved by the WRIA 9 Oversight Group, made up of city representatives in the WRIA 9 geographic area. While they have participated in technical efforts in the past, currently the Muckleshoot Tribe has declined to participate in the WRIA 9 planning effort.

Scope of Activities

- ☐ Develop and implement a Near-Term Action Agenda in 2001
- ☐ Develop and implement a Strategic Assessment by 2003
- ☐ Write a multi-salmonid species recovery plan for the Duwamish-Green River by 2005
- ☐ Identify and implement projects for salmon recovery

Project Identification

In 1997, the WRIA 9 jurisdictions joined together with the U.S. Army Corps of Engineers (Corps) to do a General Investigation Ecosystem Restoration Study (ERS) in the watershed. The study identified more than 70 fish and wildlife restoration projects. About 50 of these projects have now gone through the feasibility analysis. In addition, a few of the restoration projects were rerouted through the Corps 1125 process and have been completed or are currently underway. The Environmental Impact Statement for the ERS was completed in 2000.

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Table D-3: Duwamish-Green (WRIA 9) Reported Flow Information (Page 1 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Newaukum Creek	RM 3-9 (Enumclaw Plateau Reach)	Aug, Sept.	Chinook, sockeye, coho, chum, winter steelhead, coastal cutthroat	This reach has the most significant source of spawning gravel in the middle reach of the mainstem Green River since Howard Hanson Dam (HHD) was built. "Significant numbers" of spawning chinook. Average 7-day low flows decreased between 1953 and 1992. Low flows are an issue during chinook migration ³	WRIA 9 Draft Reconnaissance/Limiting Factors Report (Kerwin and Nelson, December 2000) (Includes reference to Muckleshoot Indian Tribe Low Flow Trend Analysis for Newaukum Creek)	
Soos Creek	?	Aug, Sept	Chinook, sockeye, coho, chum, winter steelhead, coastal cutthroat	Low flows reduce ability of chinook to reach Soos Creek Hatchery (specific locations not identified) ³ Declining trend in average 7-day low flow between 1967 and 1995 Summer low flows limit available rearing production Preliminary modeling studies suggest use of groundwater produces impacts on surface water	WRIA 9 Draft Reconnaissance/Limiting Factors Report (Kerwin and Nelson, December 2000) USGS Preliminary Modeling, 1989 reported in WRIA 9 Draft Reconnaissance/Limiting Factors Report (Kerwin and Nelson, December 2000)	
North Fork Green		Aug, Sept.		Concerns that North Fork Green River wellfield may be limiting flows – recommended for further study	WRIA 9 Draft Reconnaissance/Limiting Factors Report (Kerwin and Nelson, December 2000) Chapter 5, Hydrology	

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Table D-3: Duwamish-Green (WRIA 9) Reported Flow Information (Page 2 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Upper Green-Mainstem (RM 93 – 64.5)		Spring	Chinook, sockeye, coho, chum, winter steelhead, coastal cutthroat	Storage of water in spring reduces flows for juvenile salmon to migrate to the Sound	1995 DEIS for Howard Hanson Dam (Corps, 1995)	Potential for enhanced or adjusted augmentation exists under Tacoma Water's HCP commitments to ensure flow does not drop below 225 cfs at the Auburn gage.
Lower Green - Mainstem (RM 32-11)		Aug, Sept	Chinook, sockeye, coho, chum, winter steelhead, coastal cutthroat	Tacoma withdrawals and urbanization affect flows; a protection program is in place and a flow regime has been established Summer flows are often below state-established minimum instream flow standards established for Palmer and Auburn gages ⁴ Low flow augmentation already occurs as release of water by HHD	WDOE 1988 IRPP and 1989 Ecology IFIM Tech. Bulletin (WDOE, 1989)	Potential for enhanced or adjusted augmentation exists under Tacoma Water's HCP commitments

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Table D-3: Duwamish-Green (WRIA 9) Reported Flow Information (Page 3 of 3)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Middle Green - Mainstem (RM 64.5-32)		Aug, Sept	Chinook, sockeye, coho, chum, winter steelhead, coastal cutthroat	7-day low flow declines at Palmer and Auburn. Low flow augmentation already occurs as release of water by HHD Summer flows are often below state-established minimum instream flow standards established for Palmer and Auburn gages ⁴	WRIA 9 Draft Reconnaissance/Limiting Factors Report (Kerwin and Nelson, December 2000) WDOE 1988 IRPP (cites varying state standards by type of diverter) and 1989 Ecology IFIM Tech. Bulletin (WDOE, 1989) (recommends different flows for peak habitat by species)	Potential for enhanced or adjusted augmentation exists under Tacoma Water's HCP commitments to ensure flow does not drop below 225 cfs at the Auburn gage.

NOTES:

¹ The "critical" low flow period usually occurs in the late summer (August and September). However, different periods in salmonids' life histories in fresh water may require varying instream flow requirements. Hence, it is possible that there could be different detrimental "low flows," depending upon river channel and fish life history in a particular water body.

² Low instream flows can occur due to urbanization, groundwater withdrawals, surface water diversions, and natural causes. Often the case is a combination. The Forum is focusing on identification & mitigation of the effects of human impacts.

³ Affects of urbanization, groundwater withdrawals, and weather can and have reduced summer low flows, which may delay upstream chinook migration in Newaukum and Soos Creeks (Kerwin and Nelson, 2000).

⁴ Palmer gage regulates diversions upstream of the Palmer gage (located at RM 60.4), and Auburn gage regulates diversions between the Auburn and Palmer gages (between RM 60.4 and 32).

GENERAL NOTE: The Forum is attempting to report the greatest concerns for low flows in the basin. WRIA 9 Technical Committee members have found water quantity information to be one of their largest data gaps. When identifying other limiting habitat factors, the technical committee identified some flow-related problems, as presented above. However, the technical committee requires additional scientific study before they can consider this list of low flow issues to be comprehensive and can subsequently prioritize flow problems in this system.

SOURCES:

Kerwin, John and Tom S. Nelson. December 2000. "Habitat Limiting Factors and Reconnaissance Assessment Report: Duwamish-Green and Central Puget Sound Watersheds, Water Resource Inventory Area 9 and Vashon Island." King County Department of Natural Resources and Washington Conservation Commission. Seattle, Washington

U.S. Army Corps of Engineers. December 1995. Howard Hanson Dam DEIS for Operations & Maintenance. Seattle, Washington.

WDOE (Washington Department of Ecology). June 9, 1988 "Instream Resource Protection Program (IRPP), Duwamish-Green River Basin, WRIA 9" Chapter 173-509 WAC (cites varying state standards by type of diverter)

WDOE (Washington Department of Ecology). July 1989. Green River Fish Habitat Analysis Using the Instream Flow Incremental Methodology, Wa. Dept of Ecology IFIM Technical Bulletin 89-35 (recommends different flows for peak habitat by species)

The Corps, King County, local cities, state and federal fish and wildlife agencies, congressional representatives, and others worked very hard to get \$115 million authorized in the Water Resources Development Act of 2000. Of this amount, 65 percent would ultimately be federally funded, and 35 percent would be funded from a number of local sponsors. The planning, engineering, and design process will take place this year and construction is to begin next year. Construction is planned for each of the next 10 years.

Assessment Approach

Short-term: As mentioned earlier, WRIA 9 has just completed a Limiting Factors and Reconnaissance Assessment Report which lays the groundwork for future assessment work. A nearshore report was published in May 2001.

Long-term: Over the next 6 months WRIA 9 will be developing a work program for a strategic assessment effort. This effort will identify and implement high priority research efforts in the WRIA based on key findings and data gaps identified in the Limiting Factors and Reconnaissance Assessment Report. Results of the strategic assessment are expected to be compiled in a report in 2003.

Mechanism for Identifying Water Quantity Needs for Fish

The WRIA 9 Limiting Factors and Reconnaissance Assessment Report identified some concerns as well as data gaps regarding current withdrawals and flow manipulations in the Green River mainstem. Habitat problems related to these activities that have been identified include: low summer flows, increased gravel scour, and spring migration delays. Additional research in this area may be part of the WRIA 9 Strategic Assessment.

Puyallup-White (WRIA 10)

Located primarily in Pierce County, the WRIA 10 watershed covers nearly 1,000 square miles and originates on the slopes of Mount Rainier. The White River converges with the Puyallup River near Puyallup. Major tributaries of the White River include the Greenwater River, Clearwater River and Canyon Creek. In addition to the White River, major tributaries to the Puyallup include the Carbon River and Mowich River. Two independent basins—Hylebos and Wapato Creeks—drain directly to Commencement Bay.

Cities and towns within WRIA 10 include Tacoma (Commencement Bay), Puyallup, Orting, Buckley, Enumclaw, Federal Way, Bonney Lake, South Prairie, Wilkeson, Milton, Edgewood, Fife, Carbonado, Pacific, Sumner and parts of Auburn. Most of the eastern half of the WRIA is forested; the lower watershed is a mix of agricultural, residential, urban, and industrial areas. Gravel dredging and other flood control practices have also altered the lower watershed. The lowest reaches of

the Puyallup are heavily industrialized. Although surface water sources within this WRIA are used for water supply, no major water supply storage has been developed. However, the U.S. Army Corps of Engineers operates Mud Mountain Dam on the White River for flood control and low flow augmentation. Instream flow requirements have been enacted for WRIA 10, which supports runs of chinook, coho, pink, and chum salmon (Ecology 1995d).

Overview of WRIA 10 Activities

Summary

The Puyallup-White watershed (WRIA 10) is currently planning under House Bill 2496. Pierce County is the lead entity administering the process in the Puyallup River Watershed. In this watershed, the Puyallup River Watershed Council (PRWC) provides the foundation for citizens and stakeholders interested in promoting and implementing programs that restore, maintain, and enhance the watershed in order to protect its environmental, economic, and cultural health. The Fish and Wildlife subcommittee of the PRWC provides scientific input on issues of interest to the council, including the ranking of projects proposed for funding under the Salmon Recovery Funding Board. Including the late 2000 grant funding cycle, 16 projects with a total project cost of over \$5 million have been funded in WRIA 10 through this process.

Pierce County is the lead entity administering the process in the Puyallup River Watershed. The Fish and Wildlife subcommittee and the PRWC serve as the Technical Advisory Group and Citizens' Committee respectively. The Council has developed a WRIA 10 "Strategy for Habitat Protection and Rehabilitation." Based on recommendations in the Limiting Factors Analysis (Washington Conservation Commission, August 1999), the strategy emphasizes the protection of good stream habitats that remain, and restoration of floodplain and estuarine habitats on the mainstem rivers.

WRIA 10 Reported Flow Information Matrix

As part of the HB 2496 process, a Limiting Factors Analysis (LFA) was prepared for the Puyallup-White Watershed (Washington Conservation Commission 1999). The information on low flow issues presented in Table 5-6 has been extracted primarily from the LFA with follow-up communications with members of the Fish and Wildlife subcommittee. Preliminary results of a fish habitat modeling effort (Ecosystem Diagnosis and Treatment [EDT]) process underway in the WRIA (Mobrand Biometrics 2001) have also been used to supplement the matrix.

Long-term flow information is available for the mainstem rivers from USGS gaging stations. The hydroelectric facility bypass reaches on the Puyallup

and White River mainstems have reduced flows because of the hydroelectric diversions. Minimum flows in the bypass reaches have been increased in recent years by agreements between the tribes and Puget Sound Energy.

On the lower Puyallup River, at Puyallup, the 7-day low-flow has decreased steadily for at least the past 20 years. This does not appear to be related to reduced precipitation and has occurred despite an Ecology action to close the river to further surface water appropriations in 1980 (WAC 173-510).

There is little substantive information on low flows in the tributary streams that might impact fisheries habitat and even less on comparative historical low flows.

Interim Information as of 02/28/01

Table D-4: Puyallup-White (WRIA 10) Reported Flow Information (Page 1 of 2)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Swan Creek - 10.0023	All	Summer/Fall	Coho, chum	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer, 2001)	
Squally Creek - 10.0024	All	Summer/Fall	Coho, chum	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer, 2001)	
Canyon Creek - 10.0026	All	Summer/Fall	Coho, chum	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer, 2001)	
Diru Creek - 10.0029	All	Summer/Fall	Coho, chum	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer, 2001)	
Fennel Creek - 10.0406	All	Summer/Fall	Coho, chum, chinook, steelhead, pink		WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer 2001)	
Jovita Creek - 10.0033	All	Summer/Fall	Coho, chum	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer 2001)	
Boise Creek - 10.0057	All	Summer/Fall	Coho, chum, chinook, steelhead	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999) and personal communications, Don Nauer, WDFW (Nauer, 2001)	
Bowman Creek - 10.0042	All	Summer/Fall		Creek is a regulated release from Lake Tapps, managed by PSE.	WRIA 10 LFA (Washington Conservation Commission, 1999)	
White River bypass reach		All	All	See Note 4	WRIA 10 LFA (Washington Conservation Commission, 1999)	
White River - 10.0031	RM 0 - 29.6	All	All	WAC instream flow requirements are frequently not met - 303(d) listed	WRIA 10 LFA (Washington Conservation Commission, 1999)	

Interim Information as of 02/28/01

Table D-4: Puyallup-White (WRIA 10) Reported Flow Information (Page 2 of 2)

River/Creek	Reach	Critical Time of Year ¹	Fish Species	Issue ²	Information Source	Mitigation to Date
Wapato Creek - 10.0017	All			303(d) listed for flow, critical problem in this creek		
South Prairie Creek 10.0429	RM 0 to 15.7	Summer/Fall	All, esp. coho	See Note 5	WRIA 10 LFA (Washington Conservation Commission, 1999)	
Puyallup River - 10.0021	Lower	Fall	All	WAC instream flows are not met avg. of 35 days/yr	WRIA 10 LFA (Washington Conservation Commission, 1999)	
Puyallup River - 10.0021	Electron Bypass	All	Chinook, coho, and steelhead, bull trout	See Note 6	WRIA 10 LFA (Washington Conservation Commission, 1999)	
Hylebos Creek	All	Summer/Fall	Chum, coho	See Note 3	WRIA 10 LFA (Washington Conservation Commission, 1999)	

NOTES:

- ¹ The "critical" low flow period usually occurs in the late summer (August and September). However, different periods in salmonids' life histories in fresh water may require varying instream flow requirements. Hence, it is possible that there could be different detrimental "low flows," depending upon river channel and fish life history in a particular water body.
- ² Low instream flows can occur due to urbanization, groundwater withdrawals, surface water diversions and natural causes. Often the case is a combination. The Forum is focusing on identification and mitigation of the effects of human impacts.
- ³ Each of these streams probably had low summer/fall flows historically. While there is not supportive data, watershed development and groundwater withdrawals may have further reduced flows. Riparian function is also impaired in these streams; large wood has been removed from the stream, removal of trees from the riparian corridor has prevented recruitment of large wood to the channel, and channelization or ditching have further simplified in-stream habitat. Most significant is the reduced frequency of pools. Low flows would compound the effects of a simplified channel morphology. Increased flow without improving channel characteristics may have little benefit.
- ⁴ A minimum flow of 130 cfs is maintained in the bypass reach by agreement between the Muckleshoot Tribe and Puget Sound Energy. Negotiations to re-license the facility by the Federal Energy Regulatory Committee (FERC) are underway. Under the new license, NMFS, USFWS, and WDFW have requested that low flows be required to be approximately 2-3 times greater.
- ⁵ The City of Buckley withdraws 2.0 cfs for municipal water supply. This has the potential to reduce available rearing habitat and may cause upstream and downstream migration delays.
- ⁶ Streamflow in the Puyallup River is reduced by diversion to the Electron hydroelectric facility at RM 41.8 since it was constructed in 1904. Prior to agreement with the Puyallup Tribe in 1997, the river was substantially dewatered between RM 41.8 and the return flow at RM 31.8. The agreement now in place calls for minimum flows of 60 or 80 cfs depending on the season.

GENERAL NOTE: The Forum is attempting to report the greatest concerns for low flows in the basin. Water quantity information is one of the largest data gaps in the assessment of WRIA habitat. When identifying other limiting habitat factors, some related flow problems were also identified, as presented above. However, additional scientific study is required before this list of flow issues can be considered comprehensive and be prioritized within the basin.

SOURCES:

Nauer, Don. 2001. Personal communications.
 Washington Conservation Commission. August 1999. "Habitat Limiting Factors (LFA): Water Resource Inventory Area 10, Puyallup-White Watershed." Olympia, Washington.